

Remarks

Entry of the amendments presented, and allowance of all pending claims are respectfully requested. Claims 1-14 and 30-35 are now pending.

By this paper, claim 1 is amended to more particularly point out and distinctly claim the subject matter of the present invention. By this amendment, the subject matter of dependent claim 8 is incorporated into claim 1. Therefore, claim 8 is canceled without prejudice. Claim 9 is canceled as then being duplicative of claim 2. New claims 34 & 35 are added to recite one embodiment of the present invention wherein the second solder bumps have a uniform composition and melt at a lower temperature than the first solder bumps. Support for these claims can be found throughout the application as filed, including the example solder compositions presented at page 16 of the specification. No new matter is believed added to the application by the amendments presented.

In the Office Action, claims 1-13 & 30-33 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ju et al. (U.S. Patent No. 5,497,258) in view of Dalal et al. (U.S. Patent No. 5,796,591), while claim 14 was rejected under 35 U.S.C. §103(a) as being unpatentable over Ju et al. and Dalal et al. and further in view of Degani et al. (U.S. Patent No. 5,646,828). These rejections are respectfully, but most strenuously, traversed and reconsideration thereof is requested.

An "obviousness" determination requires an evaluation of whether the prior art taken as a whole would suggest the claimed invention taken as a whole to one of ordinary skill in the art. In evaluating claimed subject matter as a whole, the Federal Circuit has expressly mandated that functional claim language be considered in evaluating the claim relative to the prior art. Applicants respectfully submit that the application of these standards to the independent claims presented herewith leads to the conclusion that the recited subject matter would not have been obvious to one of ordinary skill in the art based on the applied patents.

As recited in claim 1, for example, applicants' invention comprises a structure which has a first substrate and a second substrate, and first solder bumps and second solder bumps offset therebetween. The first solder bumps and the second solder bumps are separate solder

bump sets disposed between the first substrate and the second substrate, and the second solder bumps have at least a portion that melts at a lower temperature than the first solder bumps. Further, functionality is recited to the effect that the second solder bumps are for aligning the first substrate and the second substrate before melting the first solder bumps. A similar characterization is also present in independent claim 30. This structure and function is very different from the teachings of Ju et al. and Dalal et al., either alone or in combination.

Ju et al. teaches a structure having a first set of solder bumps (25 or 36/25) and a second set of solder bumps (26 or 36/26) offset between a first and second substrate. A careful reading of Ju et al. fails to uncover any teaching, suggestion, or implication that the different solder bumps have different melting temperatures. For an alleged teaching of this concept, the Office Action relies upon of Dalal et al.

Dalal et al. describe a direct chip attached circuit card wherein an IC chip 30 includes a solder bump 38 with a cap of low melting point metal 41 (e.g., tin). Solder bump 38 aligns over and connects to a copper pad 20 disposed above a laminate 10. The Office Action characterizes Dalal et al. as disclosing in FIG. 5, and col. 8, lines 48-51 bumps (38) having at least a portion (41) that melt at a lower temperature than other bumps (20). This characterization of the teachings of Dalal et al. is respectfully traversed to the extent deemed applicable to the claims presented herewith.

Applicants' independent claims expressly recite first solder bumps and second solder bumps wherein the second solder bumps have at least a portion that melts at a lower temperature than the first solder bumps. The copper pad 20 in Dalal et al. is simply adjoining metallurgy to which the solder bump 38 is to be connected. One skilled in the art would not read the teachings thereof as somehow suggesting that copper pad 20 is a "solder bump". The phrase "solder bump" refers to a particular metallurgy, which is clearly distinct from copper pads or copper lines on the adjoining structure. Thermal cycling is employed to melt a solder bump and electrically interconnect two structures. Copper pads do not melt during this thermal cycling. In fact, it would be impossible for Dalal et al. to melt copper pads 20, since the organic laminate on which the pads are disposed would be destroyed as well as any

other copper lines which may be present. Thus, applicants respectfully traverse the characterization of copper pad 20 as a “bump” functionally equivalent to applicants’ recited solder bump structure. Applicants’ application is directed to a structure having “first solder bumps and second solder bumps”. Because of this, applicants respectfully submit that one of ordinary skill in the art would not have read the teachings of Dalal et al. as being applicable to their recited solder bumps. Since in Dalal et al., the “bump” comprising copper pad 20 is a completely different metallurgy and does not melt in order to electrically interconnect two structures.

In addition, a careful reading of both Ju et al. and Dalal et al. fails to uncover any teaching, suggestion or implication to one of ordinary skill in the art of two different sets of solder bumps, with one set of solder bumps having a melting temperature that is different from the other set of solder bumps. In this regard, please reference new claims 34 & 35. In view of this omission in the applied art, applicants respectfully request reconsideration and withdrawal of the obviousness rejection to the independent claims presented. If Dalal et al. were to be combined with Ju et al., then one of ordinary skill in the art would combine the solder bump cap presented therein and all the solder bumps (25 or 35/25) and (26 or 36/26), and not just on one set of solder bumps as suggested in the Office Action. In Dalal et al. all solder bumps are of a composite solder bump structure. The “bumps” comprising copper pads 20 simply do not comprise “solder bumps”, and applicants respectfully submit that there is no suggestion in the applied art to use Dalal et al. on only one set of solder bumps, and not the other set of solder bumps.

Still further, neither Ju et al. nor Dalal et al. are differentiating between different solder bumps and applying a different melting temperature to the first solder bumps and the second solder bumps to achieve enhanced alignment as recited by applicants in the independent claims presented. For example, claim 1 is further characterized to recite that the second solder bumps are for aligning the first substrate and the second substrate before melting the first solder bumps. A careful reading of col. 5, lines 32-34 and FIGs. 8A-8C of Ju et al. (i.e., the art cited by the Office Action regarding the subject matter of prior claim 8) fails to uncover any teaching, suggestion or implication of this concept. The alignment reflow discussed by Ju et al. occurs concurrently across all solder joints. There is no

differentiation in Ju et al. between the first solder bumps and the second solder bumps as having different melting temperatures, nor of such a concept being used to facilitate alignment of a first substrate and a second substrate. Applicants' independent claims specifically recite functionality which states that the second solder bumps accomplish this alignment before melting of the first solder bumps. The term "melting" means that the solder bumps becomes altered from a solid to a liquid state. Thus, in applicants' claimed invention, the second solder bumps have at least a portion that melt at a lower temperature and this facilitates alignment of the first substrate and the second substrate before the first solder bumps ever melt. In Ju et al., both sets of solder bumps would necessarily melt at the same time since both have the same composition. Therefore, applicants respectfully request reconsideration and allowance of the independent claims presented.

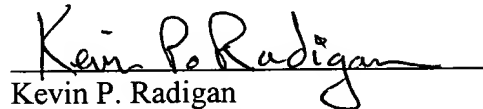
Claim 10 further states that the second solder bumps melt at a temperature at least 25°C less than the first solder bumps. This claim is submitted as a characterization on the second solder bumps melting at a "lower temperature" than the first solder bumps. A careful review of FIG. 5 and col. 8, lines 49-57 of the Dalal et al. (cited in the Office Action), fails to uncover any relevant discussion to the claimed subject matter. The Office Action again characterizes the copper pads 20 in Dalal et al. as somehow comprising a second set of solder bumps as recited by applicants. This characterization is believed erroneous. Copper pads represent a completely metallurgy than solder bumps and are not relevant to applicants' claimed subject matter. The characterization "solder" is a well-known metallurgy to those skilled in the art, and copper does not comprise solder as the term is understood. Therefore, the rejection of this claim is believed based upon a misinterpretation of the teachings of Dalal et al., and reconsideration thereof is requested.

For all of the above reasons, applicants respectfully submit that all claims presented herewith patentably distinguish over Ju et al. in view of Dalal et al. The dependent claims are believed allowable for the same reasons as the independent claims (i.e., claims 1 & 30) as well as for their own additional characterizations.

Applicants respectfully request reconsideration and withdrawal of the obviousness rejections contained in the Office Action.

Applicants' undersigned attorney is available should the Examiner wish to discuss this application further.

Respectfully submitted,

A handwritten signature in black ink, reading "Kevin P. Radigan", is written over a horizontal line.

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